26

CONSTRUCT NEW PARK AND RIDE LOTS

Definition:

This TCM would construct about 7,500 new park-and-ride spaces in 22 new lots throughout the region available for carpooling or bus commuting. The lots are described below.

Reference Number	Name/ Facility	County	Demand	R/S	Bus	Rail
30	Middletown	Bucks	154	X	X	X
32	Bristol	Bucks	371	X		
33	Bensalem	Bucks	429	X		
35	Bensalem	Bucks	544	X		X
74	Bristol	Bucks	279	X	X	X
56	E. Whiteland	Chester	105	X	X	X
59	Valley	Chester	218	X	X	X
62	Westown, Thornberry	Chester	281	X		
65	Radnor	Delaware	374	X	X	X
66	Marple	Delaware	590	X	X	
67	Nether Providence	Delaware	617	X	X	X
68	Chester/Ridley	Delaware	481	X	X	X
37	Upper Moreland	Montgomery	114	X	X	
41	Montgomery	Montgomery	112	X	X	
42	Upper Dublin	Montgomery	289	X	X	
43	Plymouth	Montgomery	232	X	X	
45	Towamencin	Montgomery	115	X		
53	Limerick	Montgomery	178	X		
54	Collegeville	Montgomery	115	X	X	
55	Upper Providence	Montgomery	118	X	X	
34	Normandy	Philadelphia	662	X	X	
36	N.E. Philadelphia	Philadelphia	1145	X		
			7523			

Travel and Emissions Analysis:

The methodology adapted here differs from a pure empirical approach used in other studies because of some special conditions: (1) Preliminary detailed estimates by DVRPC of lot utilization, showing person trips from each lot to a system of 10 regional destinations; and (2) a new feature in the TDM model that allows on-line review and editing of individual trip table Origin-Destination trip flows/mode split.

The procedure used for evaluation was as follows:

1. Determine the Planning Area (District) identity of each lot location and each of the 10 destinations.

2. Using the **F10** trip table editing function in the TDM Model, access and print out the trip table information for each of the O-D pairs in #1.

3. The task is to modify the modal split in the affected O-D pairs consistent with the "demand" precipitated by the lot. The DVRPC study estimates the breakdown of demand (persons utilizing spaces) for each destination. For example, if a lot has a demand of 200 (implies utilization of 200 spaces by users, which we do not question), the DVRPC table will indicate the demand from the lot to destination *x*, which may be King of Prussia. Suppose this demand is 60 trips. The task is then to look at the trip table for the lot to King of Prussia, and modify the mode split by 60 trips to place those people into the appropriate alternative modes.

   This manipulation will be done by proportioning demand to the trips based on (1) the type of lot — transit, rideshare or mixed use; and (2) the existing mode split.

- If the lot is *transit only*, take the quoted "demand" from the DVRPC tables, double the number because the O-D tables are daily two-way, increase transit person trips by this amount, and reduce private vehicle trips in proportion to the current vehicle occupancy rate. For example, if the figures suggest a "demand" of 60, that would be 120 new transit trips for the given O-D. If the average vehicle occupancy is 1.07 for private vehicle travel (calculated by subtracting transit trips from person trips and then dividing by vehicle trips), then the 120 new transit trips would reduce vehicle trips by 120/1.07 = 112.

- If the lot is *rideshare only*, then demand will come from both drive alone and transit. First calculate transit loss: multiply current transit share (transit trips divided by person trips) times lot demand for that O-D times 2 for daily. Subtract this demand from transit trips in the trip table. Then calculate the reduction in vehicle trips: divide the residual demand (person demand minus transit demand) by 2.5 persons per vehicle, and subtract this amount from the vehicle trip total for that O-D.

- If the lot is *mixed use*, assign the demand proportionately based on current transit and auto use rates. First multiply current transit share times the stated demand times 2 for daily. Add this

to the transit total for the O-D pair. Take the remaining demand (multiplied by 2) and divide by 2.5 persons per vehicle. Subtract this vehicle trip change from the vehicle trip total in the trip table.

4. Make these changes for each affected O-D pair using the **F10** function in the TDM model. Save the revised trip tables under a different name, reflecting all the Park and Ride lots in the regional sample. Then merge these with total trips, run through assignment and proceed to emissions modeling.

Cost Methodology:

This measure would construct 7523 surface park-and-ride spaces in 22 lots. The construction cost used was $4,000 per space, which does not include any land costs. The construction was amortized over a 20-year period with an 8% discount rate. The other portion of the public cost was for the additional transit users using the methodology documented for TCMs 9, 10, and 11. The operating cost per space was assumed to be $0.50 per day. The parking is free, and therefore, there are no private costs.

27

EXPAND PARKING AT RAIL STATIONS

Definition:

This TCM would construct about 6,400 new parking spaces at rail stations throughout the region.

According to SEPTA's parking expansion program, parking will be expanded at the following stations by 1996:

Line	Station	County	# of New Spaces
R3	Yardley	Bucks	120
R3	Woodbourne	Bucks	101
R3	Langhorne	Bucks	50
R3	Neshaminy Falls	Bucks	62
R3	Trevose	Bucks	46
R3	Elwyn	Delaware	122
R3	Media	Delaware	40
R3	Moylan-Rose Valley	Delaware	26
R3	Philmont	Montgomery	76
R3	Bethayres	Montgomery	92
R3	Forest Hills	Philadelphia	60
R5	Link Belt	Bucks	250
R5	Thorndale	Chester	450
R5	Daylesford	Chester	118
R5	Devon	Chester	85
R5	Malvern	Chester	150
R5	Whitford	Chester	150
R5	Colmar	Montgomery	246
R5	Gwynedd/202	Montgomery	400
R5	Ft. Washington	Montgomery	240
R5	Ardmore	Montgomery	250
R7	Croydon	Bucks	69
R7	Cornwells Heights	Bucks	1842
R2	Baldwin/Crum Lynne	Delaware	1000
R2	Marcus Hook	Delaware	100
R6	Norristown Trans. Center	Montgomery	109
BSS	Fern Rock	Philadelphia	112

Travel and Emissions Analysis:

This measure was evaluated through the TDM Model using a technique similar to the procedure outlined for Measure 26:

1. The planning area (district) for each transit station/lot expansion was identified.

2. It was assumed that all persons using these station/park and rides had destinations in downtown Philadelphia (district 1).

3. Using the **F10** function in the TDM model, current modal split was determined between the district containing the P&R lot and the destination (district 1).

4. New transit demand is assumed to equal the number of new spaces (assume all the spaces will be utilized). Take the new transit riders from the current mode split identified in (3) in proportion to current mode split.

5. Adjust trip table elements for all affected O-Ds in the TDM model with **F10** function. Save as revised set of trip tables showing effects of the entire system of park and ride lots.

6. Merge these revised HBW trip tables with all other travel, run assignment and calculate emissions effects with PPAQ.

Cost Methodology:

This measure would construct 6400 additional parking spaces at 27 new lots. The cost methodology is the same as in TCM 26.

28

COMPREHENSIVE BICYCLE IMPROVEMENTS IN THE REGION THAT WOULD CAPTURE 5% OF AUTO WORK TRIPS WITH A LENGTH OF 5 MILES OR LESS

Definition:

This measure would determine the effectiveness of attracting a higher percentage of work trips 5 miles or less to bicycle.

Travel and Emissions Analysis:

This analysis was performed using sketch planning techniques.

1. The current share of work trips made by bicycle was determined from 1990 NPTS data. In urbanized areas with a population of 1 million or more, with rail transit, the percentage of regional HBW trips made by bicycle is 0.27%. This figure concurs with findings of the National Bicycling and Walking Study: *Case Study No. 1: Reasons Why Bicycling and Walking are not Being Used More Extensively as Travel Modes.*

   An analysis of DVRPC trip distributions by trip length indicates that 36% of all HBW person trips are 5 miles or less. If we assume that all bicycle trips are 5 miles or less in length, then the bicycle share of HBW trips $\leq$ 5 miles = 0.27% $\div$ .36, or 0.75%.

2. Since specific bicycle improvement projects could not be assessed, bicycle use rates for work found in metro areas that had reasonably active bike programs, including facilities, were copied from the National Bicycling Study cited above. These areas (Tucson, Palo Alto, Seattle, Phoenix, Minneapolis, and San Diego) had an average bicycle use rate of 2.2%. The regional bicycle work trip goal was set to 2.2%, which equals 5.8% of trips under 5 miles.

3. The task is to increase bicycle trips $\leq$ 5 miles to 5.8%, less the existing rate of 0.75%, which is a net increase of 5%, or 79,185 daily bike trips.

4. All interchanges (O-D pairs) in HBW trip tables with trip lengths of 5 miles or less were selected. The number of trips and modal split was determined. The 79,185 new bicycle trips were pulled from the total person trip population above, in proportion to population.

5. Once the number of person trips for each O-D pair to be converted to bicycle is known, the trips are then further proportioned out of existing modes according to the existing share.

6. This manipulation is done for all affected O-Ds pairs, and the results are used to create new HBW trip tables. These trip tables are merged with total travel, assigned to the highway

network, and run through PPAQ for emissions.

Cost Methodology:

This measure would construct the required bicycle facilities to capture 5% of auto work trips with a length of 5 miles or less. The calculation of the capital cost of additional bicycle facilities was taken from the City of Chicago, CATS Conrail Bikeway Phase I Study, using only the engineering and construction costs. Using a 20-year amortization and an 8% discount rate, the cost per bicycle mile traveled is $0.13. The transit costs were calculated using the same methodology as in TCMs 9, 10, and 11. The private cost would include the cost of providing bicycle lockers at the place of employment. Each bicyclist would have a bike locker available at their work place. The cost of the bicycle lockers was $1,000 apiece (from CATS study), amortized over ten-years at a discount rate of 8%. Commuters will use biking as an alternate mode for only four months of a year.

29

COMPREHENSIVE BICYCLE IMPROVEMENTS IN THE REGION THAT WOULD CAPTURE 5% OF ACCESS TRIPS OF 5 MILES OR LESS FOR WORK PURPOSES TO 14 SELECTED RAIL STATIONS

Definition:

This measure would determine the effectiveness of drawing a higher percentage of persons within 5 miles of a rail station to access that station by bicycle.

Travel and Emissions Analysis:

This analysis was performed using sketch planning techniques.

1. Fourteen rail stations were identified which were felt to be likely candidates for access/utilization improvements directed at the bicycle mode. These stations are listed below, along with their current usage (taken from 1991 SEPTA Rail Passenger Survey):

Station	District	Inbound Boardings	% Work (Peak)	Riders Peak	New Bike Riders
Elwyn	17	329	.903	659	34
Media	17	401			
Langhorne	49	377	.908	342	17
Somerton	12	484	.935	452	23
Jenkintown	32	1082	.915	990	50
Levittown	50	456	.861	393	20
Torresdale	48	672	.945	635	32
Fox Chase	11	1050	.903	948	47
Paoli	19	1185	.908	1076	54
Bryn Mawr	34	916	.826	756	38
Overbrook	4	450	.878	395	20
Ambler	31	661	.875	579	29
East Falls	9	278	.817	617	31
Wyndmore	9	477			

The number of new bike riders shown above is multiplied by 2 to get daily bike trips.

2. The rail survey suggests that the current average bicycle access rate to these stations is about 1%. It is assumed that the share of persons within a 5 miles radius accessing the station by bicycle is increased to 5 percent of all trips. It is further assumed that improved access by bicycle will not affect the total trip mode split (to the ultimate destination) by shifting more

people to rail transit, but will only help to pull current private vehicle users out of short vehicle access trips in the vicinity of station.

3. For each station/district, all adjacent zone pairs with trip lengths of 5 miles or less were arrayed. The number of bicycle trips calculated above were extracted from current vehicle and transit trips in proportion to the person trips for each station area.

4. All of the adjustments were compiled into a single new HBW trip table, merged with total trips, assigned to the network, and run through PPAQ for emissions.

Cost Methodology:

This measure would attract 5% of work destination rail access trips $\leq$ 5 miles onto bicycles. The methodology was the same as in TCM 28, except that the bicycle lockers would be a public cost at rail stations. Again, bicycle trips will be used to access rail stations for only four months of the year.

30

COMPREHENSIVE BICYCLE IMPROVEMENTS IN THE REGION THAT WOULD CAPTURE 5% OF NON-WORK TRIPS WITH A LENGTH OF 5 MILES OR LESS

Definition:

This measure would determine the effectiveness of attracting a higher percentage of non-work trips less than or equal to 5 miles to bicycle.

Travel and Emissions Analysis:

This analysis was performed using sketch planning techniques.

1. The current share of non-work bicycle trips was estimated from the 1990 NPTS data to be 0.89% for areas with a population over 1 million, with rail transit.

2. Set the goal for non-work trips. If the increase due to bicycle improvements for work trips was 1.93% (2.2% - 0.27%) regionally, and 5% for trips under 5 miles, then seek to increase non-work bicycle trips by 1.93%. (1.93% x 13,532,122 non-work person trips = 261,170 new bicycle trips).

3. These 261,170 new bicycle trips were taken entirely from district-to-district interchanges (O-D pairs) where trip lengths are 5 miles or less. The base for this manipulation is 7,741,288 trips. The 261,170 bicycle trips were taken in proportion to O-D person trips first, and then from existing modes within the O-D pair in proportion to the current mode split.

4. New regional non-work trip tables reflecting these adjustments were formulated, merged with other travel (HBW), and run through a new network assignment. The new assignments were processed with PPAQ to estimate emissions.

Cost Methodology:

This measure would attract 5% of the non-work trips with a length of 5 miles or less to bicycle. The methodology is similar to TCMs 28 and 29, except that the bicycle lockers would be privately funded and used four times per day instead of once a day. Also, non-peak transit headways and service are not adjusted to reflect a reduction in ridership since the headways are policy driven and not capacity driven. However, transit revenue is reduced to reflect a drop in ridership.

31

REMOVAL OF PRE-1980 VEHICLES

Definition:

This TCM would attempt to eliminate half of all cars built before 1980 that are still in service. These vehicles produce emissions that are many times those of vehicles manufactured after 1980.

Travel and Emissions Analysis:

Assumptions:

- Only emissions rates will be affected. No changes in travel will result.
- Registered vehicles in the region will remain constant.
- Vehicle age distribution closely parallels the corresponding VMT values.

Procedure:

The input vehicle age distribution data for running MOBILE5a was adjusted to reflect the implementation of this measure. MOBILE5a was run and the emissions effects calculated.

Cost Methodology:

This measure purchases pre-1980 vehicles from private owners. The cost per vehicle purchased was $700, plus the public administration fee of $50 per vehicle. The purchase price was not amortized.

32

REDUCTION IN COLD STARTS

Definition:

This TCM would attempt to eliminate 5% of all vehicle cold starts across the region through a concerted public education program.

Travel and Emissions Analysis:

Assumptions:

- A public education program can be successful in eliminating 5% of cold starts.
- 10% of the total reduction in cold starts will come from people foregoing their normal trip. This results in a 0.5% drop in trips and VMT (=10% * 5%). The other 90% reduction in cold starts will come from changes in trip patterns and scheduling and presumed to have no net impact on trips or VMT. All of this 90% reduction would come from HBO and NHB trips proportionally (70% vs. 30%).
- The program will only affect vehicle trips produced within the Pennsylvania portion of the DVRPC region. Daily vehicle trips produced in Pennsylvania portion are:

HBW	2,134,050
HBO	3,765,222
NHB	2,059,180
TOT	7,958,452

- The education program only affects personal travel and the resulting change in trips is not large enough to affect average highway speed.
- Average trip lengths by purpose (miles):

HBW	8.0
HBO	5.6
NHB	5.0

- Proportion of trips that are cold starts:

HBW	90%
HBO	50%

NHB 40%

Based on the assumptions stated above, the reduction of cold starts and the corresponding VMT was computed manually. The reductions were entered into an analysis spreadsheet and estimated emissions effects were calculated.

Cost Methodology:

This measure is a public information program to reduce cold starts affecting personal travel. It was assumed that the public information program would cost $750,000 annually with most of the cost for producing and distributing audio, video and text materials.

33

CALIFORNIA CARS

Definition:

This TCM would implement the California program requirements (emissions standards and fleet make up).

Travel and Emissions Analysis:

Assumptions:

- Only emissions rates will be affected. No changes in travel will result.

Procedure:

Appropriate changes were made to the MOBILE5a setup and the resulting emissions were calculated.

Cost Methodology:

This measure would most likely be implemented after 1996. The cost to achieve the emissions reduction assumes that the first year of implementation would be 1996 model year cars and that 10% of the registered autos will be purchased in model year 1996 and that 10% of the new cars purchased would be California low emissions vehicles (LEV). The private cost per LEV used was $205 per vehicle.

34

FEEBATE ON PURCHASE OF NEW CAR

Definition:

This TCM encourages consumers to purchase new cars with higher efficiency characteristics. Specifically, it would evaluate the EPA test case of placing a fee on the purchase of vehicles with poor MPG, with a maximum of $1364 on vehicles attaining no more than 21 mpg, and a maximum rebate of $395 on 45 mpg vehicles.

Upon further discussion, the definition of this TCM has been revised to reflect a feebate schedule that induces emissions improvements rather than MPG. Indeed, vehicles with higher fuel economy may well produce higher emissions.

Travel and Emissions Analysis:

The feebate schedule is the same as that used by EPA in their 1991 study:

MPG	Fee/(Rebate)	MPG	Fee/Rebate
45	$(395)	31	$472
43	(286)	29	621
41	(173)	27	781
39	(56)	25	960
37	55	23	1154
35	193	21	1364
33	329		

Source: Meeting Mobility and Air Quality Goals: Strategies that Work (EPA, Office of Policy Analysis, January 1993)

Assume that the fee structure will be linked to emissions instead of MPG. The fee system applied to emissions is estimated to produce an improvement in average MPG for current model year cars from 27 in 1991 to 33 in 2000, an improvement of 22.2% This translates to a 2.2% per year improvement; we assume the same improvement would translate to emissions.

Thus: were this system to be instituted in 1995, then 1995 model year cars would be 2.2% cleaner than they would have been otherwise, and 1996 model year cars would be 4.4% cleaner. To evaluate impact on regional emissions, adjust the emissions factors in MOBILE to reflect these improvements for this portion of the stock.

Cost Methodology:

This measure provides a rebate to the purchase of new cars that are lower in emissions than the regular new car standard. The new cars that produce higher levels of emissions would be charged a fee (tax). The program would be established to pay for itself except for the administration fee. This fee was estimated to be $500,000 annually.

35

COMPREHENSIVE GAS TAX

Definition:

This TCM is defined as a comprehensive regional gas tax of $0.84 per gallon.

Travel and Emissions Analysis:

Evaluation was made with the DVRPC regional mode choice model applied to both work and non-work travel. The cost increase per gallon was translated to a cost per mile through assumption of a 21 mpg per average vehicle (then deflated by 0.58 time inflation factor).

Revised trip tables will be run through network assignment and then PPAQ for emissions estimation.

Cost Methodology:

This measure would increase gasoline taxes by $0.84 per gallon. The number of gallons consumed was calculated assuming a 21 miles per gallon average vehicle fleet rate and proportioned from the VMT tax of 4 cents per mile. An administration cost of $750,000 was assumed for collection of additional tax and auditing the tax collection program.

	CHANGE IN HOME-BASED WORK TRAVEL		CHANGE IN TOTAL TRAVEL		CHANGE IN TOTAL VMT	CHANGE IN EMISSIONS		
	Vehicle Trips % Change	Transit Trips % Change	Vehicle Trips % Change	Transit Trips % Change	Veh-Miles % Change	kg of VOC % Change	kg of CO % Change	kg of NO_x % Change
Base Condition unty PA Region Only	2,066,000 (a)	456,000 (a)	10,092,000 (a)	764,000 (a)	71,701,500 (b,c)	79,500 (b)	510,500 (b)	111,000 (b)
enario								
adherence to speed limit on npike	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	-161 -0.2	-5,230 -1.0	-567 -0.5
TRANSIT OPERATIONS								
tion of service onal rail lines	-1,000 -0.0	1,267 0.3	-1,255 -0.0	1,998 0.3	-10,360 -0.0	-10 -0.0	-61 -0.0	-18 -0.0
ion of Route 66 ss trolley	-154 -0.0	171 0.0	-278 -0.0	364 0.0	-1,360 -0.0	-2 -0.0	-10 -0.0	-3 -0.0
vement to express on regional rail	-368 -0.0	466 0.1	-505 -0.0	731 0.1	-14,752 -0.0	-14 -0.0	-87 -0.0	-26 -0.0
nwide fare ions of 10%	-4,693 -0.2	5,505 1.2	-9,497 -0.1	13,164 1.7	-73,488 -0.1	-84 -0.1	-506 -0.1	-118 -0.1
nwide fare ions of 20%	-8,275 -0.4	9,696 2.1	-16,762 -0.2	23,473 3.1	-144,016 -0.2	-178 -0.2	-977 -0.2	-238 -0.2
nwide fare ions of 50%	-19,970 -1.0	23,409 5.1	-42,071 -0.4	58,884 7.7	-362,432 -0.5	-425 -0.5	-2,460 -0.5	-622 -0.6
ve suburban bus e	-5,373 -0.3	6,161 1.4	-7,248 -0.1	9,216 1.2	-54,000 -0.1	-61 -0.1	-393 -0.1	-92 -0.1